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Agricultural Memorandum No. 928

M N Hough

Simulation of Winter Wheat Growth - Results for Bridget's EHF

Agricultural Memorandum 921 reported the results of using a cereal growth simulation model to calculate the growth of frequently measured crops of winter wheat grown in plots at Sutton Bonington. This memorandum gives the results of calculating winter wheat growth for crops grown on a field scale according to commercial practice.

Crop Data

Winter wheat was grown in eight fields in 1980/81 at Bridget's Experimental Husbandry Farm (P.B. Harris, personal communication (1981)). The measurements were of leaf area and crop dry weight in the third and fourth weeks of May and in early July. A third dry weight sample was made for two fields on 31 July. Five 1 m^2 samples were taken from each field for the dry weight determination, and from each sample five tillers were chosen for leaf area measurements.

The data for LAI and dry weight were plotted on graphs, one for each field, and curves were drawn through the data points. Since there were only two data points for many of the curves, heavy reliance was placed on the typical shapes of the curves for other crops which have been measured in much greater detail. This method will cause most uncertainty for dry weight and LAI before the first data point in May. The position, and height of the LAI peak in June will also be in doubt. The error in LAI is probably 10-15%; for dry weight, the standard error of the mean is plotted on the graphs.

Discussion

The winter was fairly dry with temperatures not far from normal. March was wet and very mild and near or above average rainfall continued to May. June was drier. Each month from April to July had below average sunshine. As a result of this crop growth was not restricted by lack of water until July, but radiation values were low throughout the growing season. August was warm and dry with good harvest conditions.

Two calculated curves are shown for each field, one gives the total dry weight and the other is above ground dry weight. It is this latter curve which is to be compared with the observations. Agreement between the two curves is reasonable over much of the season both in absolute yield and in gradients. Georgia and New Hants East fields were not modelled very well. With Georgia the model crop grew too fast even during the main growth period in June, which is usually modelled fairly well. Disease was known to be present in New Hants East, but the observed yield is well above the model yield!

Respiration During Grain Growth

The large fall in the calculated total dry matter yield at the end of the growing season is shown in the graphs and has been mentioned before (Ag. Memos 921 and 892). It is thought to be because the model assumes that all the dry weight respires even at the end of growth when some parts are dying. Monteith (personal communication 1981)) suggests that respiration is about 40% of gross photosynthesis throughout the life cycle of the crop. If this figure for respiration is used in July only,

then a more realistic curve is obtained. On the graphs the total dry matter curve shows the large drop in July, but the above ground dry matter curve, which has been calculated assuming the 40% respiration described above, is more reasonable.

Acknowledgements

I am grateful to Mr P Harris for the crop weight and leaf area measurements, and to the Director of Bridget's EHF for permission to do these measurements.

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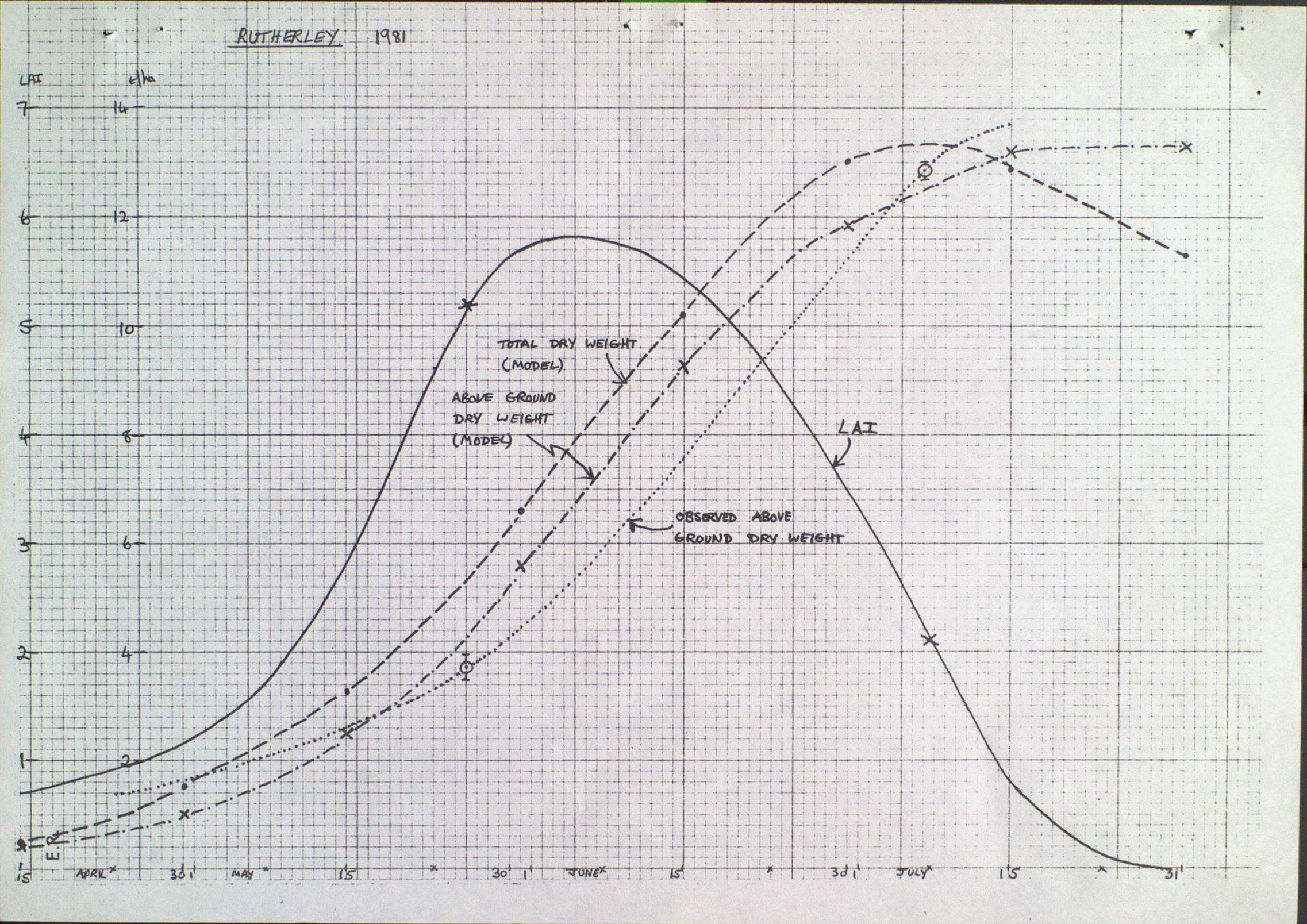
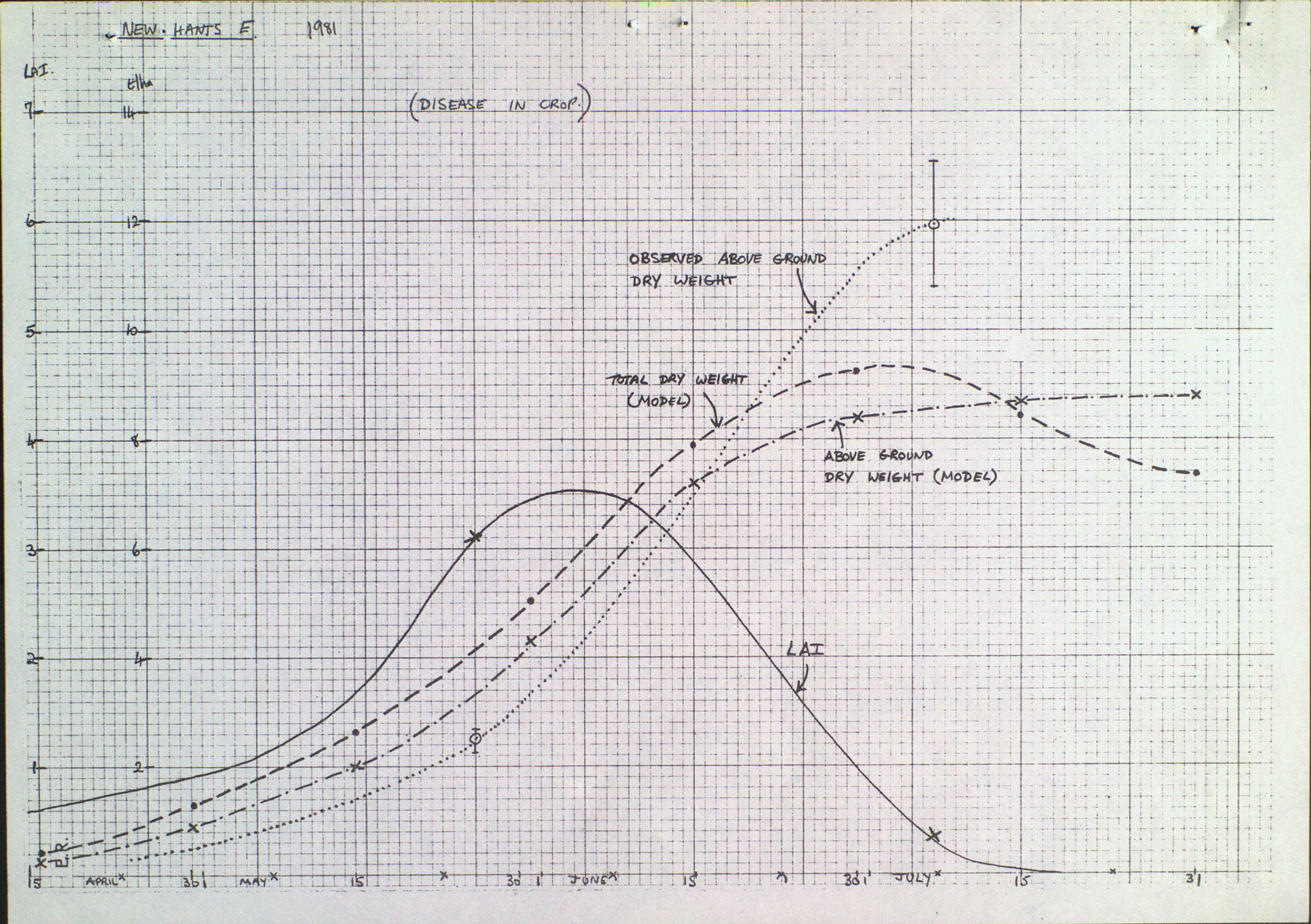
MAFF

October 1981


RUTHERLEY 1981
LAI
t/ha
7
6
5
4
3
2
1
16
12
10
8
6
4
2
TOTAL DRY WEIGHT
(MODEL)
ABOVE GROUND
DRY WEIGHT
(MODEL)
LAI
OBSERVED ABOVE
GROUND DRY WEIGHT
15
APRIL
30
1
MAY
15
30
1
JUNE
15
30
1
JULY
15
31


NEW. HANTS E. 1981
LAI.
t/ha
(DISEASE IN CROP.)
OBSERVED ABOVE GROUND DRY WEIGHT
TOTAL DRY WEIGHT (MODEL)
ABOVE GROUND DRY WEIGHT (MODEL)
LAI
7
6
5
4
3
2
1
14
12
10
8
6
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2
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APRIL
30
1
MAY
15
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JUNE
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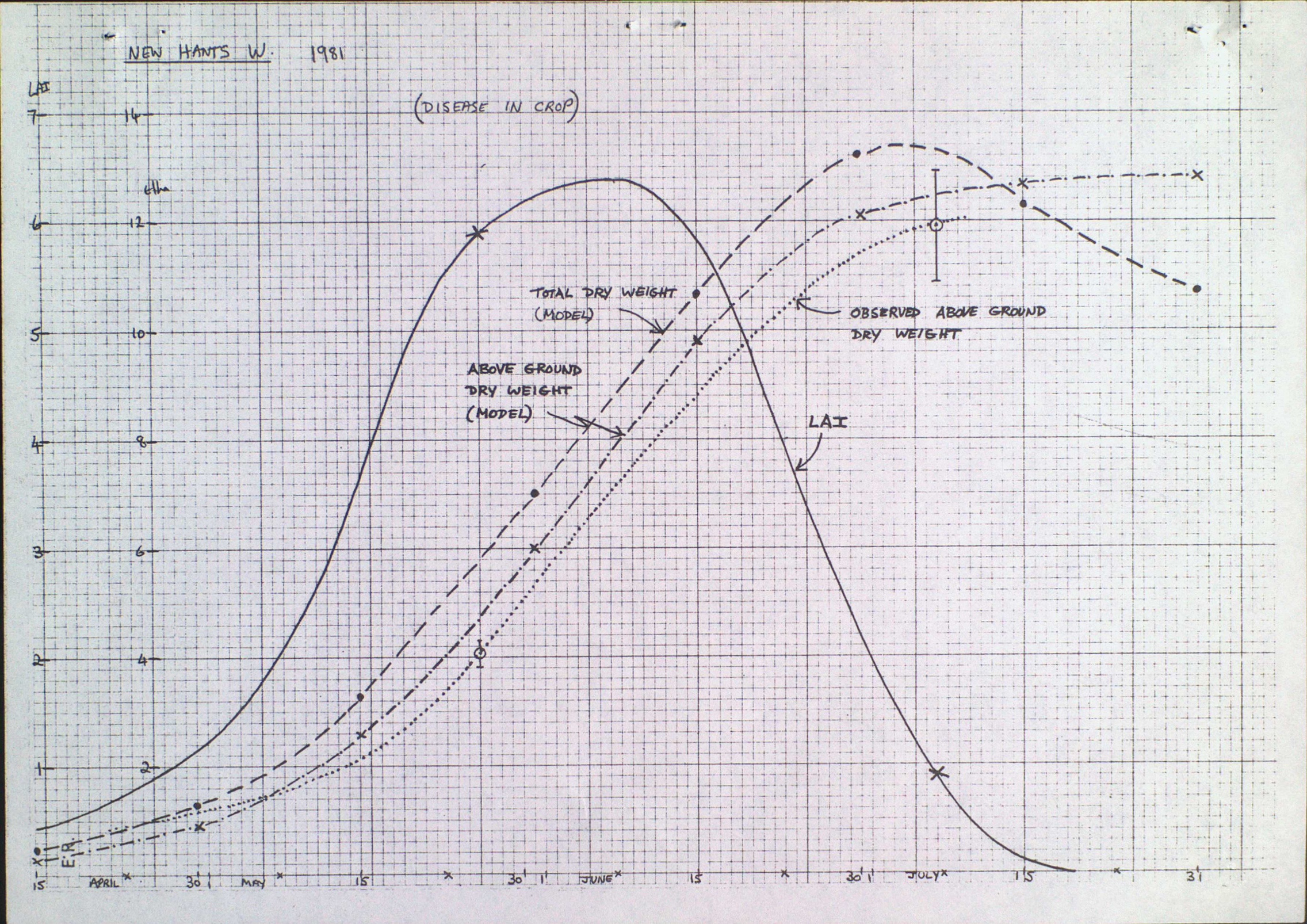
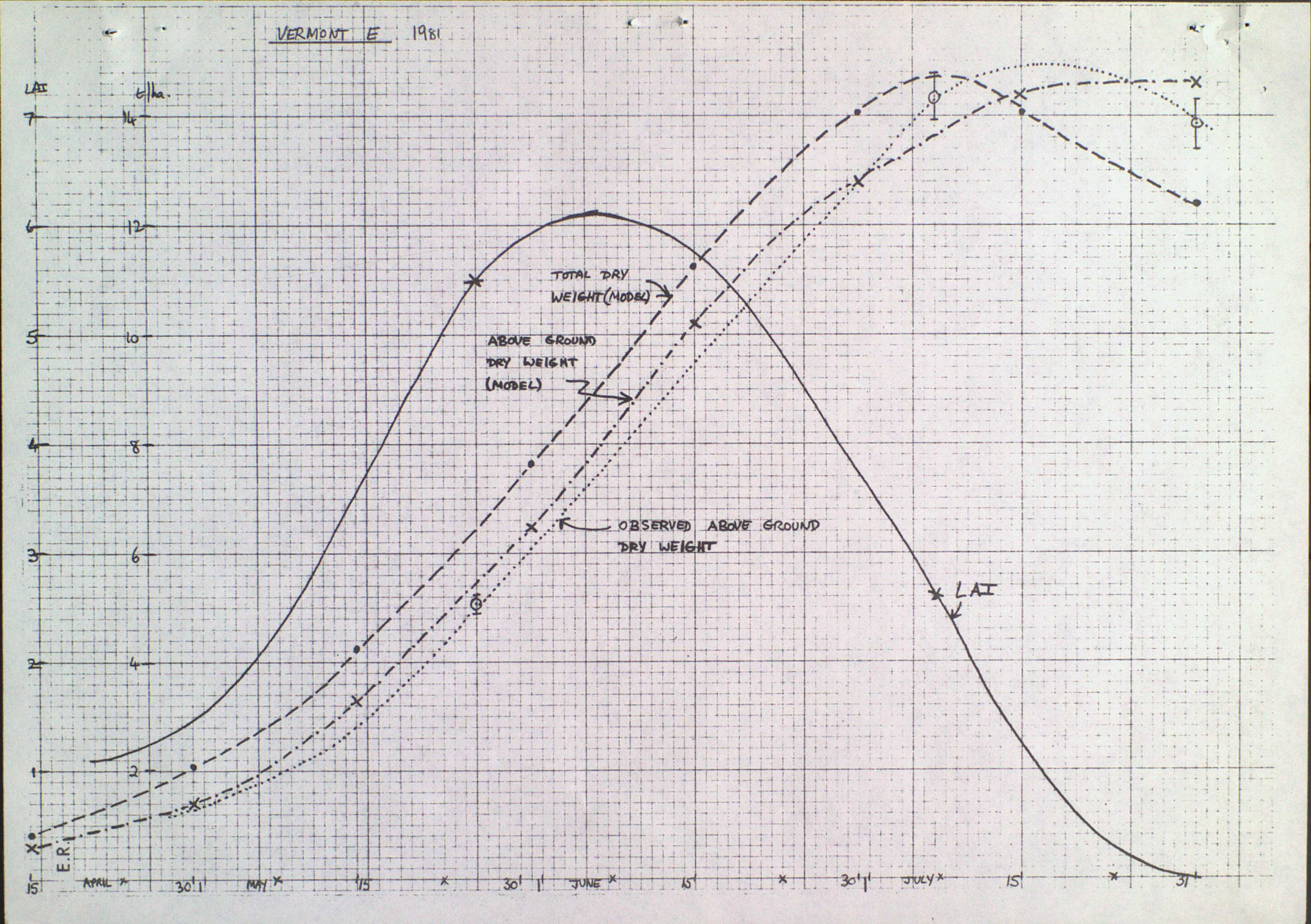
JULY
15
31


NEW HANTS W. 1981
(DISEASE IN CROP)
LAI
TOTAL DRY WEIGHT (MODEL)
ABOVE GROUND DRY WEIGHT (MODEL)
OBSERVED ABOVE GROUND DRY WEIGHT
LAI
APRIL
MAY
JUNE
JULY


VERMONT E 1981
LAI
g/ha.
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14
12
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4
2
TOTAL DRY WEIGHT (MODEL)
ABOVE GROUND DRY WEIGHT (MODEL)
OBSERVED ABOVE GROUND DRY WEIGHT
LAI
E.R.
15
APRIL
30
1
MAY
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30
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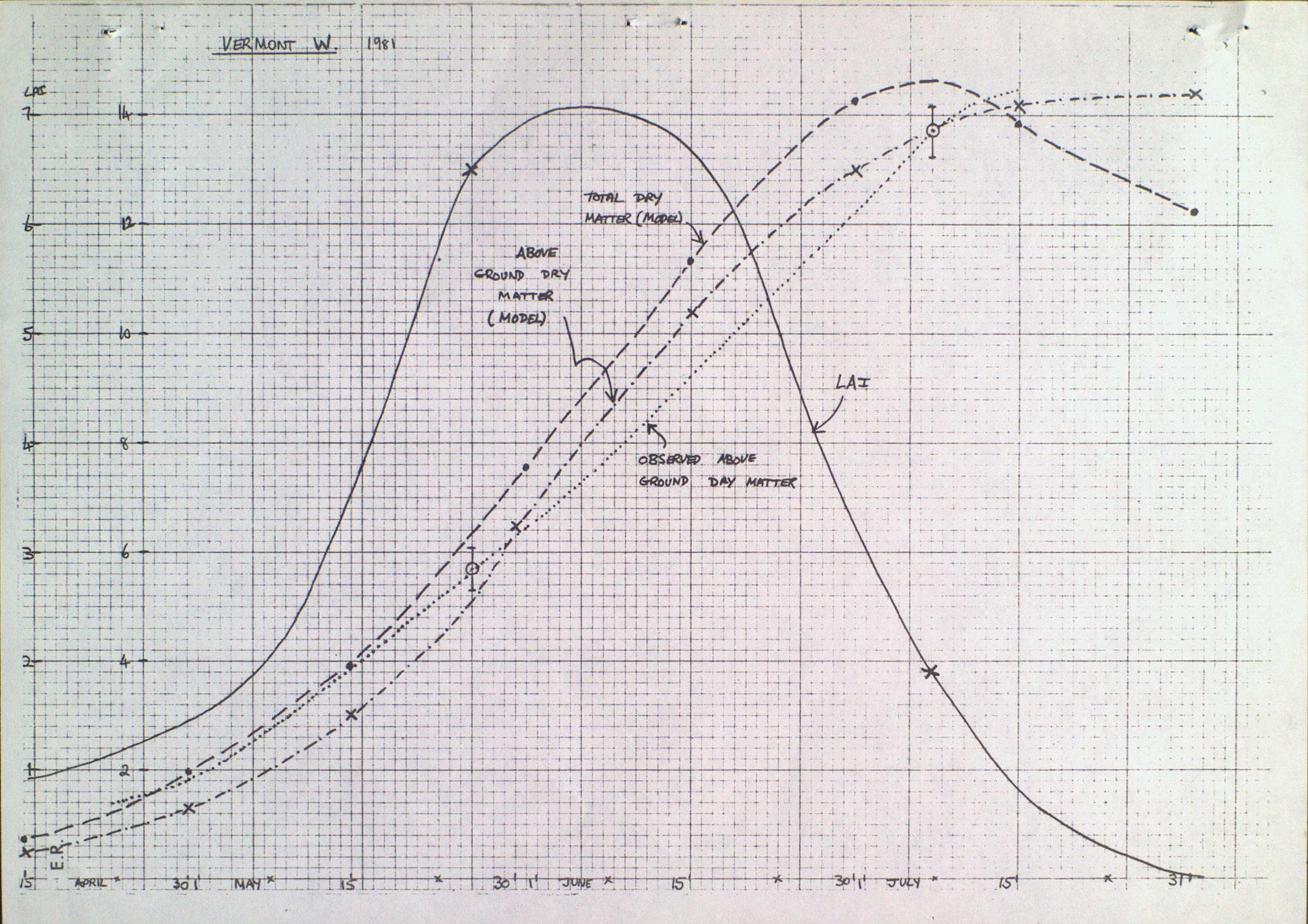
JUNE
15
30
1
JULY
15
31


VERMONT W. 1981
LAI
7
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E.R.
15
APRIL
30
MAY
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JUNE
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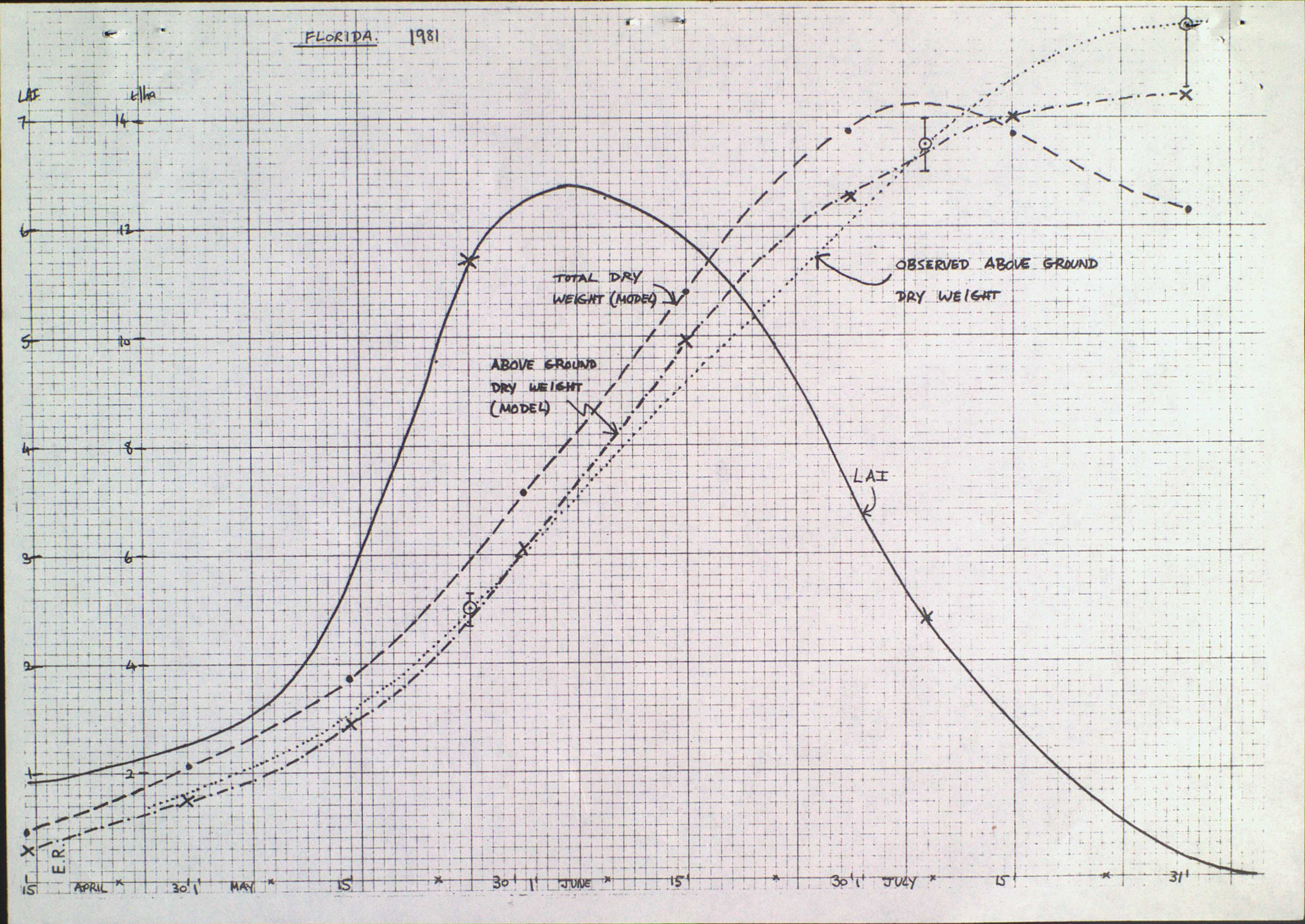
JULY
15
31
TOTAL DRY MATTER (MODEL)
ABOVE GROUND DRY MATTER (MODEL)
LAI
OBSERVED ABOVE GROUND DAY MATTER


FLORIDA. 1981
LAI
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TOTAL DRY WEIGHT (MODEL)
ABOVE GROUND DRY WEIGHT (MODEL)
OBSERVED ABOVE GROUND DRY WEIGHT
LAI
E.R.
15 APRIL
30
1 MAY
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1 JULY
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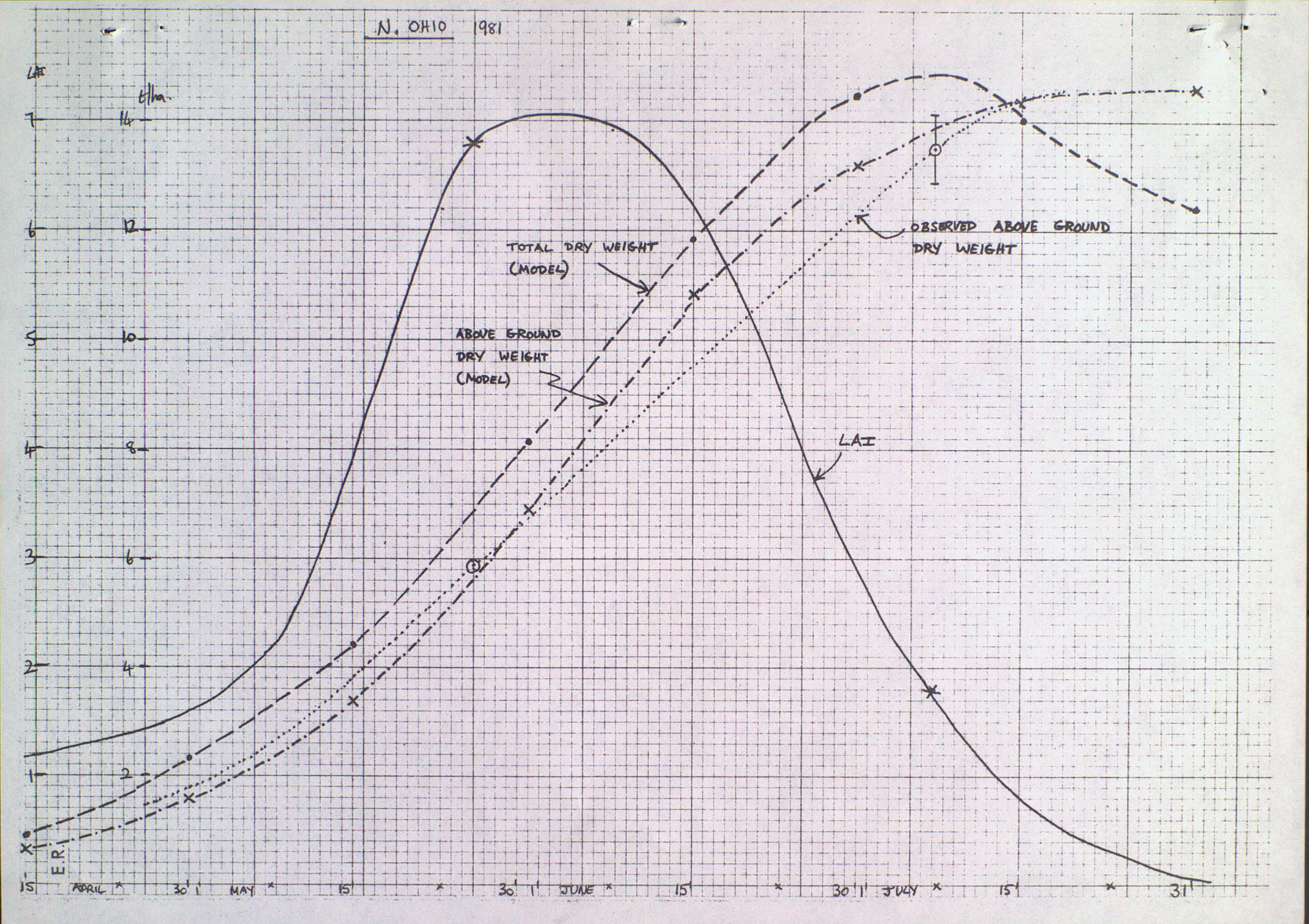
31


N. OHIO 1981
LAI
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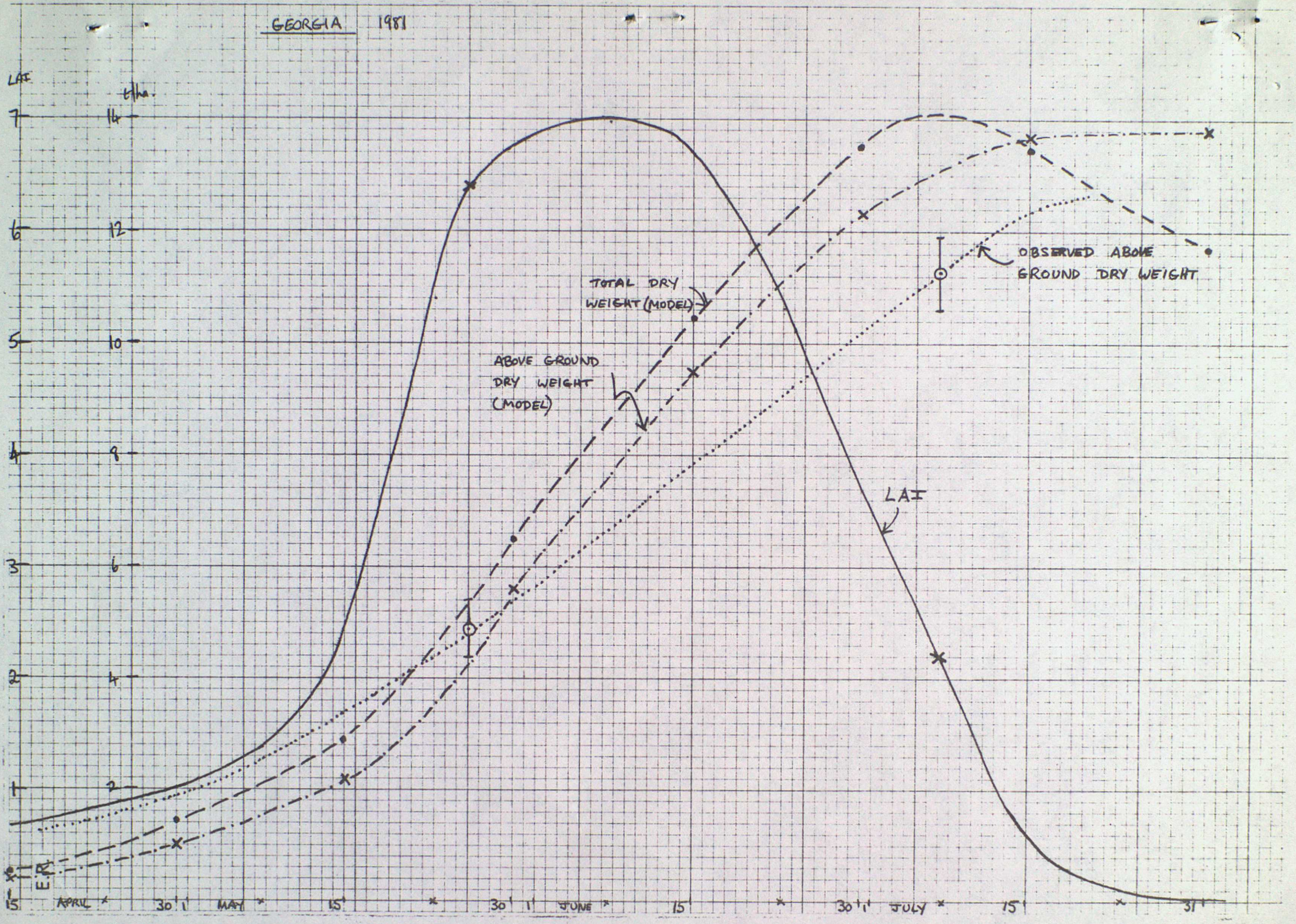
TOTAL DRY WEIGHT
(MODEL)
ABOVE GROUND
DRY WEIGHT
(MODEL)
OBSERVED ABOVE GROUND
DRY WEIGHT
LAI
E.R.
15 APRIL 30 MAY 15 30 JUNE 15 30 JULY 15 31


GEORGIA 1981
LAI
t/ha.
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2
TOTAL DRY WEIGHT (MODEL)
ABOVE GROUND DRY WEIGHT (MODEL)
OBSERVED ABOVE GROUND DRY WEIGHT
LAI
E.P.
15 APRIL 30 1 MAY 15 30 1 JUNE 15 30 1 JULY 15 31